

**National Aeronautics and Space Administration**

**Technology & Innovation Committee  
of the  
NASA Advisory Council**

**NASA Headquarters  
Washington, DC**

**April 28-29, 2011**

**MEETING MINUTES**

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*Thursday, April 28, 2011*

Opening Remarks

The NASA Advisory Council (NAC) Technology and Innovation (T&I) Committee meeting was convened by Mr. G. M. (Mike) Green, Executive Secretary. He announced that the meeting was a Federal Advisory Committee Act (FACA) meeting open to the public, and he reviewed the planned agenda for the meeting. Dr. Robert B. Braun, NASA Chief Technologist, did not attend the meeting because he was in Florida for the Space Shuttle Endeavor launch.

Opening Remarks and Thoughts

Mr. Green introduced Ms. Esther Dyson, Chair. Ms. Dyson welcomed everyone to the meeting. She noted that some Committee members had met with Dr. Joseph Parrish, Director, Early Stage Innovation Division, after the last T&I Committee meeting and received additional insight into the program's processes. Mr. Green will provide updates on developments across NASA. Ms. Dyson observed that this is a frustrating time for NASA, and she explained that NASA's capacity to implement the Committee's suggestions is limited. She reported that there was resonance with the other advisory committees at the last NAC meeting. Mr. Green noted that the NAC has issued a recommendation on FedTraveler.

Office of Chief Technologist Update

Ms. Dyson introduced Dr. Michael Gazarik, Deputy Chief Technologist, Office of Chief Technologist (OCT). Dr. Gazarik described his work at NASA and then briefed the Committee on OCT's status. OCT was established a little over a year ago and is working on an OCT operating plan. Dr. Ballhaus observed that it was getting late in the fiscal year and asked whether it would be difficult for OCT to spend funds appropriated to it by the end of the fiscal year. Dr. Gazarik agreed that the timing would present challenges; however, they are doing as much advance planning as possible in order to be able to proceed once the budget is finalized. He noted that NASA's Space Technology Program, managed by OCT, is a \$1,024 million budget line in the President's proposed FY 2012 budget for NASA and represents approximately five percent of the President's \$18.7 billion budget request for NASA. The proposed budget includes Innovative Partnerships Office (IPO), Strategic Integration (SI), Small Business Innovation Research and Small Business Technology Transfer (SBIR/STTR), Crosscutting Space Technology, and Exploration Technology. Congressional reaction to the President's proposed budget for OCT, particularly the Space Technology Grand Challenges, has been mixed. Dr. Gazarik explained that by investing in high payoff, disruptive technology that industry cannot tackle today, the Space Technology Program matures the technology required for NASA's future missions in science and exploration, while proving capabilities and lowering the cost. He asserted that technological leadership is the "Space Race" of the 21st Century. NASA's Space Technology investments will stimulate the economy and build the Nation's global economic competitiveness through the creation of new products and services, new business and industries, and high-quality, sustainable jobs. Dr. Gazarik presented several charts describing trends in NASA's overall budget and the Space Technology budget. In FY 2012, a significant portion of the FY 2010 Exploration Technology Development Program, as well as the exploration technology activities in planning for FY 2011, will move from the Exploration Systems Mission Directorate (ESMD) to the Space Technology Program. At Mr. Gordon Eichhorst's request, Dr. Gazarik explained that a line item, the "Shuttle pension", refers to a defined budget amount that NASA is contractually obligated to fund for United Space Alliance (USA), a NASA contractor. This is part of the termination liability for shutting down the Space Shuttle Program. He explained that the strategic guidance for Space Technology will come from NASA's Strategic Plan, the Space Technology Grand Challenges, and the Space Technology Roadmaps.

Dr. Gazarik presented charts showing Space Technology's development approach across OCT's three divisions. The Early Stage Innovation Division sponsors a wide range of low Technology Readiness Level (TRL) efforts for advanced space system concept and initial technology development. Included in this division are the Space Technology Research Grants Program, the NASA Innovative Advanced Concepts (NIAC) Program, the Center Innovation Funded Program, the Centennial Challenges Prize Program, and

the SBIR/STTR Program. The Game Changing Technology Division focuses on maturing advanced space technologies that may lead to entirely new approaches for the Agency's future space missions and solutions to significant national needs. The Crosscutting Capability Demonstrations Division focuses on maturation to flight readiness of cross-cutting capabilities that advance multiple future space missions, including flight test projects where in-space demonstration is needed before the capability can transition to direct mission application.

The Committee discussed the technology budgeting methodology used for the Department of Defense. In response to a question from Ms. Dyson, Dr. Gazarik stated that synthetic biology would be located primarily at the Ames Research Center (ARC). The 14 Space Technology Roadmaps are being reviewed by a National Research Council (NRC) steering committee chaired by Dr. Raymond Colladay. Mr. Eichhorst expressed the need for timelines and milestones. Dr. Gazarik explained that the roadmaps are a draft, living document, and that what is missing is a prioritization, which he anticipates receiving from the NRC. Ms. Dyson expressed an interest in having Dr. Colladay brief the Committee at its next meeting at Ames. Dr. Alain Rappaport requested information on internal efforts at prioritization. Dr. Susan Ying asked how "push and pull" would be balanced in the prioritization process. Dr. Gazarik explained that the "pull" would come from the Mission Directorates, and that the "push" would come from the low TRL spectrum. Dr. Yang expressed concern over the possibility that "push" priorities might be ignored. Dr. Gazarik observed that there may not be a roadmap for the "push" priorities. The Committee discussed the Center Director's accountability for ensuring that projects receive sufficient infrastructure support. Dr. Ballhaus contended that the Center Director was little more than a spectator in this process and did not have true accountability. Dr. Gazarik stated that conflicts between program authority and technical authority would have to be resolved by NASA's Associate Administrator, Mr. Christopher Scolese. Dr. Ballhaus criticized that as being too high a level, and noted that it was formerly handled at the Center Director level. Dr. John Cassidy expressed concern that the organization might become paralyzed in the current political and financial environment, and explained that there is a need for making tough choices in order to achieve results. Dr. Gazarik submitted that prioritization should be deferred until OCT's budget had been appropriated. Ms. Dyson recommended that OCT identify the projects most likely to be achievable and descope the remainder without further delay. Several members expressed deep concern over OCT's perceived inaction, but Ms. Dyson cautioned against cynicism. Dr. Gazarik maintained that the problem was due to not having an appropriated budget. Ms. Dyson counseled that the U.S. had to "change the messaging" so as to encourage Congress to think long term. She explained that a "stop and go" process is highly undesirable and very expensive. At the Committee's request, Mr. Green distributed congressional listings.

Ms. Dyson thanked Dr. Gazarik for his presentation.

#### NASA Technology Transfer and Licensing Activities - Update and Discussion

Mr. Green introduced Mr. Douglas Comstock, Director of Innovative Partnerships Office (IPO), OCT. Mr. Comstock briefed the Committee on the OCT's programs for technology transfer and commercialization. He described OCT's Innovative Partnerships Office (IPO). IPO has primary responsibility for technology transfer and commercialization, intellectual property management, technology coordination with other Government agencies, and technology coordination with the commercial industry. In response to a question from Mr. Eichhorst on whether acknowledged open innovation has worked, Mr. Comstock responded affirmatively and added that they have to work on the "not invented here" cultural issue. Ms. Dyson counseled that what makes people's minds open is to work with outsiders. He described the Colorado Technology Acceleration Program, which is a licensing acceleration pilot. NASA intends to replicate this model in other states. Dr. Rappaport advised that it is a scalable model and that it would be better to streamline and centralize it, rather than develop it state-by-state. In response to a question from Ms. Dyson, Mr. Comstock explained that non-reimbursable Space Act Agreements are used for developing technology with larger businesses. Ms. Courtney B. Graham, Esq., NASA Office of General Counsel, recommended that NASA's contracting structure be a separate topic for a future Committee meeting. Mr. Eichhorst observed that the public does not realize the full value attributable to the technological benefits derived from NASA.

Mr. Comstock described the Innovation Ambassadors program, which is a competitively selected professional development opportunity for NASA staff. Ms. Dyson suggested expanding this to a sabbatical program. Mr. Comstock responded that the requirements for handling intellectual property rights could present an obstacle in doing so. Ms. Dyson noted that the Committee needs more information on how NASA handles intellectual property. Mr. Comstock described NASA's efforts to quantify the public benefits from technologies developed for space and aeronautics. NASA's *Spinoff Magazine* will be used to document these benefits. The benefits include jobs created, revenue generated, costs avoided, lives saved, improved quality of life, and improvements to the environment. In response to a question from Dr. Rappaport, Mr. Comstock stated that NASA is working to streamline the process to make it easier for a startup to do business with NASA.

Ms. Dyson thanked Mr. Comstock for his presentation.

#### Intellectual Property Briefing by Office of General Counsel

Ms. Dyson introduced Ms. Courtney Graham, NASA Office of General Counsel (OGC), who briefed the Committee on how NASA handles intellectual property. Ms. Graham heads the General Counsel's Intellectual Property and Commercial Law Practice Group. She explained that invention disclosures may be reported by NASA civil servants, Jet Propulsion Laboratory (JPL) employees, and contractors. Patenting decisions are handled on a Center by Center basis. Fewer than 300 invention disclosures are filed each year by NASA civil servants. She observed that when JPL is removed from the statistics, it becomes clear that NASA may not be effectively capturing civil servant innovation. Goddard Space Flight Center (GSFC) recently doubled its civil servant disclosures through training. NASA's Office of Chief Engineer (OCE), OCT, and OGC are reviewing ways to utilize award systems to improve civil servant participation in the invention disclosure process. In response to a question from Dr. Ballhaus, Ms. Graham stated that congressional ceilings on compensation are not a limiting factor here. Mr. Eichhorst noted that Johnson Space Center (JSC) recently had no budget for filing patents. Ms. Graham stated that the OGC manages the budget for patent and trademark fees. That budget has been cut in half. NASA has 16 patent attorneys, but they are often assigned other matters. She explained that technology transfer is not considered in NASA's acquisition process. Small entity contractors report more inventions than large entity contractors. NASA's title-taking authority was abrogated by the Bayh-Dole Act, which governs the transfer of government funded inventions to universities and businesses operating with federal contracts. NASA routinely waives its right to take title to inventions discovered by contractors with NASA's funds. There were, however, two recent instances where waiver requests were denied. Ms. Graham observed that the current structure limits the ability to implement Agency technology priorities through strategic intellectual property protection. It is difficult to effectively leverage technology assets that currently exist. In response to a question from Dr. Cassidy, Ms. Graham explained that "leverage" means obtaining revenues that can be added to the budget. Dr. Cassidy opined that the primary leverage is not revenue, but causing things to happen. Mr. Eichhorst noted that in private enterprise, many companies trade licenses. NASA has many license opportunities, e.g., corrosion identification technology, that could be used to trade for goods and services. Dr. Cassidy asserted that intellectual property is fundamental to the innovation equation. He asked whether NASA had a written policy on intellectual property. Ms. Graham responded that NASA is subject to regulations issued by the Commerce Department, which apply to the entire government. She summarized with a slide showing that civil servants are underreporting inventions, that there is little emphasis on capturing contractor innovation, and that NASA has no overarching strategy on patenting.

Ms. Dyson thanked Ms. Graham for her presentation and requested that she return to continue her briefing.

#### SBIR/STTR Program Status Update

Ms. Dyson introduced Dr. Joseph Parrish, Director, Early Stage Innovation (ESI) Division, and Mr. Carl Ray, SBIR/STTR Program Executive, both from OCT. Mr. Parrish explained that ESI is the seed-stage venture capitalist for NASA technology development. He presented slides on the Space Technology Grand Challenges and the Space Technology Roadmap Technical Areas (TAs). There are 13 Grand Challenges and 14 TAs. These are in developmental phase. He presented a slide showing ESI's major accomplishments to date and its plans for the upcoming year. The Phase 2 award amount for the SBIR/STTR Program has

been increased to \$750,000. Next year, Phase 1 awards will be increased to \$150,000. A call has been issued for Space Technology Research Fellowship applications. One hundred fifty fellowships may be awarded. The President's proposed FY 2012 budget request allocates \$300 million to ESI and will fund over 1,000 new projects. ESI expects to receive 10,000 proposals, and the challenge is determining the right ones to fund. In response to a question from Mr. Ballhaus, Dr. Parrish stated that a "home run" would be a game-changing innovation, e.g., a new way to put mass into orbit. He explained that ESI needs to get partners involved and to provide the richest environment possible for innovation. In response to a question from Mr. Eichhorst, Dr. Parrish stated that it is difficult to identify and apply metrics in the technology development realm. Mr. Eichhorst advised that the speed in which bad projects are killed is a measure of success. Dr. Ballhaus expressed concern that ESI might be working on the margins, rather than on the game-changers, and questioned what would happen when technology comes in from a sector that NASA is not used to working with.

Mr. Ray described the SBIR/STTR Programs. These are set-aside programs that focus on small business. SBIR helps small businesses engage in federal research and development (R&D) with potential for commercialization. STTR facilitates cooperative R&D between small businesses and U.S. research institutions with potential for commercialization. The set-asides are mandated by federal legislation for small, high-technology firms. The Programs have three phases: a feasibility study, a technology development stage, and a commercialization stage. Sole source contracts may be awarded without a justification for other than full and open competition (NO-JOFOC). Mr. Ray presented a chart showing the strategies being used to achieve the key objectives. He presented charts showing the Technology Development & Infusion Process Flow, the Program's Master Schedule, and the Program's interfaces. He discussed the Program's response to a recent investigation and audit by the Office of Inspector General (OIG). The response includes a new publication emphasizing that NASA has zero tolerance for waste, fraud, and abuse. "Virtual site visits" will be conducted to monitor firm organization, project management, firm financial status, and technical progress of the project. Mr. Ray presented a chart showing how SBIR/STTR technologies are being utilized for emissions. He described a recent commercial product spinoff, the WARP 75® light-emitting diode (LED) device, which is a high-intensity hand-held LED unit for treating chronic pain. Dr. Parrish asserted that the innovative productivity of small business is greater than large companies. He noted that ESI was engaged in a process to formalize an industry consortium to help get small business products commercialized.

Ms. Dyson thanked Dr. Parrish and Mr. Ray for their presentations.

#### NIAC Program Status Update

Ms. Dyson introduced Dr. John "Jay" Falker, Manager, NIAC Program, OCT. He explained that NIAC is a program to solicit and support early studies of innovative yet credible advanced concepts that could one day change the possible in aeronautics and space. It is the most open-ended and far-reaching of NASA's new technology programs. The program will be contained within the OCT's ESI Division. It is different from the original NIAC that existed from 1998 through 2007. The new NIAC will remain revolutionary, creative, and controversial; however, it now will allow for internal NASA participation, provide a path to Game Changing Technology (GCT) and other options, and provide a focus on "10+" years out, rather than 40 years out, which was perceived as being too remote. Dr. Falker presented a chart showing the NIAC proposal evaluation criteria. He presented a slide showing as an example the Mini-Magnetospheric Plasma Propulsion (M2P2) prototype, which is an advanced plasma propulsion system that will enable spacecraft to obtain unprecedented speeds from minimal energy and mass requirements. Another slide presented showed the New Worlds Observer (NWO), which is a large occulter in space designed to block the light from stars in order to observe their orbiting planets. He briefly highlighted the new Phase 1 and Phase 2 studies expected to be awarded.

Dr. Ballhaus advised that even with "push", there is a need to ask what the impact would be if a project is 100 percent successful; without sufficient impact, NASA should not invest in the project. In the current budget environment, he suggested, you cannot compete if you cannot demonstrate urgency or cannot "move the needle". Also, a project must be relevant to the Administrator. Mr. Eichhorst concurred with Dr. Bauhaus. Dr. Parrish argued that it would not be fair to apply the needle-moving test to NIAC projects. Ms.

Dyson observed that if a project is 100 percent successful, it might lead to a change in the roadmap. Dr. Falker stated that he manages the program by himself, with assistance from a few outside support contractors. Dr. Parrish added that approximately 200 people would be engaged in evaluating proposals for the program.

Ms. Dyson thanked Dr. Falker for his presentation.

#### Flight Opportunities Program Update

Ms. Dyson introduced Dr. Laguduva “LK” Kubendran, Program Executive, Flight Opportunities Program, OCT, who briefed the Committee about the Program. The Flight Opportunities Program was established in the OCT Crosscutting Capability Demonstrations Division in FY 2011. The Program provides flight opportunities in reduced-gravity and high-altitude environments in order to mature technology for application in future space missions. It combines fiscal year 2010 Commercial Reusable Suborbital Research (CRuSR) efforts with Facilitated Access to the Space Environment for Technology (FAST) efforts. Parabolic flights will be made using an existing contract with the Zero-G Corporation. Suborbital flights and payload integration services will be purchased through multiple vendors. Ms. Dyson announced that she had previously disclosed a financial interest in the Zero-G Corporation. Dr. Kubendran presented charts showing planned funding, proposed pronouncements of opportunities for payloads, and past parabolic flights. He described current CRuSR flights and presented a video showing actual tests. The early flights will develop standardized processes and procedures, as well as detail interfaces and logistical operations. He presented charts on notional requirements for flight opportunities and on the acquisition strategy for flight and payload integration services.

In response to a question from Dr. Ballhaus, Dr. Kubendran explained that the program coordinates with the Air Force at Kirkland Air Force Base, and that they fly on each other’s vehicles. Dr. Rappaport asked how many flight opportunities could be sustained with the Program’s budget. Dr. Kubendran stated that NASA’s answer to that question would be available next year. Dr. Ballhaus questioned whether there was a sufficient market to make these projects commercially viable. Dr. Kubendran explained that NASA could enhance the market by being an anchor tenant.

Ms. Dyson thanked Dr. Kubendran for his presentation.

#### Knowledge Management – Both Internal and External

Ms. Dyson introduced Dr. James Reuther, Director for Strategic Integration, OCT. Dr. Reuther briefed the Committee on using portfolio tracking for knowledge capture. He explained that knowledge capture means having a system that allows us to understand what we are doing and what we have done. It involves technologies in other programs and in other NASA missions that are not really technology missions. He noted that developing a comprehensive understanding on what NASA is getting for its technology investment is a big challenge. Prior to OCT, there was no home for an integrated system within NASA, and that was one reason for establishing the Office. Guidance comes from three motivating elements. The first is the NASA Strategic Plan, which was released on February 1, 2011, and which contained three goals. Goal three in the plan specified technology development. The second motivator is the NASA Space Technology Grand Challenges that encourage others to be part of NASA’s enterprise. The third motivator is the NASA Space Technology Roadmaps. Today, OCT views itself as a pipeline for people and ideas.

Dr. Reuther described the life cycle for technology projects. It begins with a solicitation or a request for a directed effort. That is followed by project formulation, proposal development, and submission. The third step is proposal review. The fourth step is project confirmation and award. The next step is project implementation, execution, and review. The final step is project close-out or termination, at which time data and knowledge is generally captured for lessons-learned and technology transfer or infusion. Any attempt to implement a portfolio system through a data call will get very little response without acknowledging the technology lifecycle. The portfolio system should, therefore, be incorporated into the project’s life cycle. There is an ongoing debate over where in the life cycle it should be inserted. OCT has decided to focus, at this time, on the last two steps in the life cycle. The system has to be useful as a project

management tool, and it has to allow the project to communicate with its stakeholders. The system must be able to import data from something such as the SBIR Electronic Handbook; otherwise, it would be counterproductive and disruptive. Ms. Dyson advised that the best way to implement a portfolio system is to have it be populated with data as people engage in their normal activities. Many projects have an annual review, and using the portfolio system for that annual review is a way to populate it with data. Dr. Reuther noted that OCT's intent is to put in place a system to manage the process. He noted that Dr. Parrish has requested a spiral approach for developing that system; accordingly, its functionality will increase over time as additional steps in the technology project life cycle are included. This remains a plan because OCT has lacked both guidance and authority to move out with its programs. Dr. Braun has directed that a portfolio system be developed. Ms. Faith Chandler, OCT, will design the system. She has previously developed a portfolio system for mishaps and understands the challenges. To date, she has interviewed OCT staff, mission directorate stakeholders, and customers. Existing systems have been examined. OCT is preparing to initiate a contract to determine what the data fields and functionality for the portfolio system should be and to translate that into initial requirements. This will be completed by the summer.

Ms. Dyson advised that it is important to build in a motivational system to encourage people to use the management system. Mr. Eichhorst suggested consulting with the Chief Technologists from the different Centers. If the system is perceived as an extra chore, it will not get populated with data. Mr. Robbie Schingler, OCT Chief of Staff, stated that OCT wants to avoid duplication and has to experiment with identifying the most effective incentives. He added that the overall architecture will be for the system to be developed openly and open sourced, to be located inside NASA's firewall to protect the data, and to be viewable by different stakeholders. Dr. Cassidy expressed concern that OCT was missing a deeper involvement with the people aspects, i.e., what people did or did not do and what it was that they did that was special; that, he opined, is what is needed in a knowledge capture system. Dr. Ying described the situation at the Boeing Company. The average age of its employees is now 55, and there is an urgent need for knowledge capture. The commercially available tools were not found to be helpful. Boeing wanted its researchers and technologists to put their "good stories" into the system. Boeing shifted its focus to a mentoring and coaching program. She cautioned that portfolio management tools can be completely misleading. In response to a question from Ms. Dyson, Dr. Reuther stated that OCT has looked into using social networking for knowledge management; however, there are concerns because they are working with proprietary data. Dr. Ballhaus advised that the best way to train a successor is for the successor to work side-by-side with his predecessor.

Dr. Gazarik expressed frustration because the budget is going down, rather than up, and he has questions about how NASA is going to bring new, talented people into the workforce and retain its young employees. Dr. Cassidy advised that OCT should be careful about reinventing the wheel and should just worry about the incentive issue. Dr. Reuther stated that knowledge capture is about connecting people to someone who has experience and can be a mentor; it is a one-to-one transmittal of that experience. Dr. Rappaport asserted that connecting the right people to the right knowledge is what is being done currently with the social networks. Ms. Dyson suggested looking at <http://ohours.org>, which is a website where people host open office hours. Dr. Cassidy opined that financial incentives are not needed for creating oral histories or for encouraging young employees to learn from those histories. Dr. Parrish stated that there are many perspectives on knowledge transfer, and that OCT needs to begin developing a prototype. Dr. Ballhaus explained that this is human capital management. He asked whether OCT had a system in place for bringing in experts. Dr. Reuther did not have information about any such system within OCT.

Ms. Dyson thanked Dr. Reuther for his participation.

The meeting was adjourned for the day.

*Friday, April 29, 2011*

#### Call to Order

Mr. Green called the meeting to order.

Announcements

Ms. Dyson welcomed the Committee Members back for the second day of the Committee meeting. She described the agenda for the day and reviewed the presentations from the previous day.

Update on National Research Council Steering Committee

Ms. Dyson introduced Committee Member Dr. Dava Newman, who was participating telephonically. Dr. Newman is also a member of the NRC Steering Committee that is reviewing the OCT Space Technology Roadmaps. At Ms. Dyson's request, Dr. Newman briefed the Committee on the status of the Steering Committee's work. Dr. Newman reported that the next Steering Committee meeting, chaired by Dr. Colladay, will be held in May 2011, in Washington, D.C. Ms. Dyson asked whether the Steering Committee would be recommending priorities among the roadmaps. Dr. Newman responded that the Steering Committee is struggling with whether there is sufficient information for that to be accomplished in a rigorous manner. Workshops have been held and there has been a lot of information; however, some roadmaps are very preliminary and need additional work. She reported that synthetic biology was not initially included in the roadmaps and may be added. Some other exciting technology areas also were not included, and the Steering Committee is considering whether to add them. Dr. Newman offered to brief the T & I Committee when there are new developments to report.

Ms. Dyson thanked Dr. Newman for her report.

SBIR/STTR Contract Severability Discussion

Ms. Dyson re-introduced Dr. Joseph Parrish, Director, ESI Division, OCT, who was participating telephonically. Dr. Parrish asked the Committee to consider issuing a recommendation calling for NASA's General Counsel and NASA's Chief Financial Officer to review a 2010 decision designating SBIR/STTR contracts as "severable" because the decision was having an adverse impact on the SBIR/STTR Program. Dr. Parrish described the background for his request and explained that the problem was attributable to statutory language for the Program, which he believed had been misconstrued. The Committee agreed to recommend that the problem be addressed, subject to Ms. Dyson gaining a better understanding on whether the problem was being caused by the language in the statute or by an erroneous interpretation of that language.

Ms. Dyson thanked Dr. Parrish for bringing the situation to the Committee's attention.

Technology and Innovation in NASA Commercial and Emerging Space Initiatives

Ms. Dyson introduced Mr. Charles Miller, Partnerships, Innovation & Commercial Space Division, OCT. He has been leading NASA's assessment activities on emerging commercial space industries. Dr. Rappaport asked him how OCT defined commercial activities. Mr. Miller responded that OCT had started with 13 priorities and evaluated every aspect of the market. They reviewed the possible benefits, synergies, and key leverage points. Low cost, reliable access to space was determined to be the most important priority. Dr. Ballhaus expressed dissatisfaction with the lack of proposed alternatives from OCT. OCT needs to lead; it is the most important thing that NASA can do. Mr. Miller suggested that it was a difficult proposition in the current political situation. There are many ideas, but OCT was not prepared to brief the Committee on them at this time.

Mr. Miller presented several charts describing OCT's recent activities in assessing emerging commercial space industries. They are actively exploring non-traditional approaches and partnerships. An Emerging Commercial Space Office was included in the President's Proposed FY 2012 Budget. It will provide a door to NASA for new commercial space concepts and ideas and will coordinate with NASA's larger, on-going Commercial Space programs. He described the first Commercial Space Opportunities Workshop that had been conducted in June 2010. Eight potential commercial capabilities were evaluated at that workshop. These were: low-cost and reliable access to space; commercial in-space servicing; commercial human

spaceflight; entertainment and education; lunar/near Earth orbit; Orbital Space Laboratory research/microgravity; new space communications and navigation; human habitation and accommodations; and power infrastructure and delivery. The latter had been evaluated as having the lowest priority. In response to a question from Dr. Ying, Mr. Miller observed that no one had analyzed whether these capabilities correlated with OCT's roadmaps. Dr. Reuther noted that this was a good suggestion. OCT should identify the technologies needed by each capability and prioritize them. He explained that the roadmaps phase in the technologies over time and connect them to the Grand Challenges. This is a complete "push" approach and examines areas not looked at by commercial enterprises. The commercial capabilities should be integrated with the roadmaps. Dr. Reuther cautioned, however, that the process should be vetted with the outside community.

Mr. Miller described the second Commercial Space Opportunities Workshop that had been conducted at NASA Headquarters in July 2010. At that workshop, the top three to five barriers to closing the commercial business case for several commercial capabilities were identified and prioritized, and options were developed for consideration by NASA's leadership. Dr. Ballhaus observed that major companies will hold back until there are orders for products, while small businesses often have a vision in which they are willing to invest. He noted, however, that getting into orbit is 50 times more expensive than suborbital flights. Dr. Reuther explained that if there were a market for suborbital flights, then NASA would not have to play a big role in its development. He stated that OCT was not going to engage in the current national debate over what launch vehicle NASA should build. Dr. Ballhaus suggested that OCT could be an advocate for key technologies. Dr. Reuther concurred with that, but cautioned that recommending systems for NASA's investment over other approaches would be intruding into the national debate and into an area in which OCT must remain unbiased. Mr. Eichhorst disagreed; he asserted that OCT has an opportunity to shape the debate and should form and present an unbiased opinion. Dr. Reuther expressed concern over taking that action when OCT has not yet received an appropriated budget. Ms. Dyson proffered that some people might say that OCT is giving opinions prematurely, while others would say that OCT is doing something valuable. Dr. Ballhaus advised that while OCT needs to be objective, it should lead when its analysis leads to a conclusion. Dr. Rappaport reminded everyone that OCT's mission was to propose "push" technologies. Dr. Reuther noted that OCT has a program for demonstration programs that can be used to demonstrate next generation technology without getting into the launch vehicle debate. This, however, is a very expensive proposition. Mr. Miller noted that there are some low-cost demonstrations where some technologies can be showcased. Mr. Reuther explained that that was the reason to stay away from a full system. Mr. Miller observed that OCT can pursue a broad approach, and that some failures are expected. Dr. Ballhaus requested a briefing on the specifics for an orbital debris removal capability. Ms. Dyson expressed concern that the Committee was hearing too much about NASA's structure and not enough about specific projects. Mr. Miller described a "NewSpace 2011" forum that is scheduled to take place at ARC on July 28-31, 2011. Ms. Dyson asked Mr. Green to ascertain whether the Committee could attend that event, and she encouraged the Committee Members to attend individually, otherwise.

Ms. Dyson thanked Mr. Miller and Dr. Reuther for their participation.

#### Ethics Briefing

Ms. Dyson introduced Ms. Kathleen Teale, Esq., OGC, NASA Headquarters. Ms. Teale briefed the Council Members on the legal requirements pertaining to ethics. Each Council Member is a Special Government Employee (SGE) and the government's ethics laws apply to all SGEs. Ms. Teale described the standards of conduct and the criminal statutes on ethics. Any Council Member having a specific issue should notify Mr. Green and obtain legal advice from the NASA OGC.

Dr. Ballhaus noted that what constitutes a "particular matter" is often subject to different interpretations and asked whether a written opinion could be provided when those issues arise. Ms. Teale advised him to bring the issue to their Office when it arises. Dr. Ballhaus informed Ms. Teale that he occasionally serves as a compensated advisor for the Jet Propulsion Laboratory (JPL), and he asked whether that was sufficient to impute JPL's financial interests to him for ethical conflicts of interest analyses. Ms. Teale advised him to meet with her in order to discuss the matter. At Dr. Rappaport's request, Ms. Teale elaborated on the ethical distinctions regarding broad policy considerations.

Ms. Dyson thanked Ms. Teale for her presentation.

Continued Discussion On Intellectual Property With General Counsel

The Committee resumed its discussion with Ms. Graham on how NASA handles intellectual property. She explained that NASA's patent program is managed at each Center on a Center-by-Center basis. The technology from each Center is not pooled in any organized way. NASA has not had a culture that focuses on technology transfer as part of its core mission. The OGC culture may need to shift. Mr. Eichhorst noted that at Caltech, patent filing is culturally viewed as an incentive. Dr. Cassidy expressed surprise that NASA had only around 900 patents in its portfolio. Ms. Graham explained that her budget, at \$200,000 per year, is a limiting factor. Dr. Rappaport noted that the full life of a patent is 20 years. Ms. Graham stated that maintenance fees must be paid periodically, and that those fees average \$2,500 per patent. For that reason, NASA seeks very few international patents. Dr. Cassidy observed that people may not bother submitting patent proposals if they see that the filings are severely limited by the budget. They also may be discouraged if they submit disclosures and nothing happens. Dr. Ying asked whether there was a process to determine whether a patent should be pursued or a paper presented, Ms. Graham responded that her Office does not make the decision; the patent is pursued if the client wants it and if her Office has the resources for it. Dr. Ying suggested that NASA explore using patents as a legal defensive strategy.

Ms. Dyson explained that there are two top level alternative strategies for how to best exploit NASA's inventions. One approach would be to issue licenses to others who have resources to exploit the inventions. The alternative approach is to open the technology to the world; however, it is unlikely that investors would be interested because they would not be able to make a profit. She asked whether NASA had a bias in one direction or the other. Mr. Eichhorst asserted that the international element has to be considered. He explained that when NASA only files for a U.S. patent, a double burden is imposed on the U.S. taxpayer because NASA funds the research and only companies operating in the U.S. have to pay licensing fees. He recommended that a credit be given for U.S. companies, and that foreign companies be required to pay a licensing fee. While this would require a larger organization for monitoring purposes, it would also raise NASA's profile as a preeminent engineering agency. Ms. Dyson suggested it would be helpful to have an assessment on the revenue that might be achieved from obtaining international patents, as well as an assessment on the benefits to the U.S. taxpayer from open-sourcing compared to patenting technology. Dr. Cassidy observed that it is unclear whether NASA has an intellectual property strategy; he recommended that there should be one. Dr. Ballhaus observed that this topic is not being considered currently by Center Directors. Dr. Rappaport asserted that culture is extremely important for talent development in motivating people to file disclosures and pursue patents. He recommended allowing small companies to patent inventions they develop with NASA funds to allow them to grow into big companies at the lowest cost. They could then invest in filing for foreign patents. He explained that foreign patents are expensive because there are so many countries where they must be filed. In response to a question from Ms. Dyson, Ms. Graham explained that a startup may not obtain foreign patents for technology licensed to it by NASA.

Dr. Rappaport recommended a streamlined process for developing a portfolio for NASA's technology that could be exploited by U.S. companies. Ms. Graham reported that NASA has attempted to auction intellectual property in bulk lots, but was unsuccessful. The Committee, at Mr. Dyson's suggestion, decided to explore in depth NASA's intellectual property strategy and make recommendations, as appropriate. Ms. Dyson stated she would like to speak with the Center technologists, and she asked the Committee Members and Mr. Green to submit suggestions on experts to advise the Committee.

Ms. Dyson thanked Ms. Graham for her participation.

Discussion and Recommendations

The Committee discussed the schedule for its next meeting. Mr. Green advised that the Committee would be participating with the NAC and the other NAC committees at ARC on August 3, 2011. Ms. Dyson requested that a half day be set aside around that date for an intellectual property briefing from Silicon Valley industry.

The Committee adopted the following recommendation:

Request that senior Agency leadership address issues surrounding the significant delays in FY 2010 and 2011 in funding SBIR/STTR awardees and work to remedy these problems for FY 2012 and beyond.

Dr. Cassidy expressed discomfort with how NASA views itself in a technological leadership sense, and how it views itself in the technological world. He explained that this is physics and chemistry, not healthcare, and that NASA is the informed agency for the U.S. and should, therefore, lead in technology. He added that it would be helpful for Dr. Braun to attend the Committee meetings and share his thinking on the issues. Mr. Green will encourage Dr. Braun to attend the meetings. Ms. Dyson noted that the NASA Administrator, Mr. Charles Bolden, will likely be at the August ARC meeting and would be available for questions. Mr. Green added that Mr. Bolden is the Committee's customer.

Ms. Dyson noted that the Committee's meeting had been the best and most useful meeting to date. She thanked everyone for their participation. She expressed particular appreciation to the staff for making the meeting so successful.

The meeting was adjourned.



**Agenda**

**NAC Technology and Innovation Committee Meeting  
April 28-29, 2011  
NASA Headquarters  
MIC 6A  
6H45**

**April 28, 2011 –**

- 8:30 a.m. Welcome and overview of agenda/logistics (FACA Session)  
Mike Green, Executive Secretary
- 8:35 a.m. Opening Remarks and Thoughts  
Esther Dyson, Chair
- 8:45 a.m. Office of Chief Technologist Update  
Bobby Braun, NASA Chief Technologist and/or Mike Gazarik, NASA Deputy Chief Technologist
- 9:45 a.m. Break
- 10:00 a.m. Update and Discussion of NASA Technology Transfer and Licensing activities  
Doug Comstock, Office of Chief Technologist
- 11:00 a.m. SBIR/STTR Program Status Update  
Joe Parrish, Director for Early Stage Division, and Carl Ray, Office of Chief Technologist
- 12:00 p.m. Lunch (On own)
- 1:00 p.m. NIAC Program Status Update  
Joe Parrish and Jay Falker, NASA Office of Chief Technologist
- 1:45 p.m. Break
- 2:00 p.m. Flight Opportunities Program Update  
Steve Meier, Director of Crosscutting Capability Division, and LK Kubendran, Office of Chief Technologist.
- 3:00 p.m. Knowledge Management – both internal and external  
James Reuther, Director for Strategic Integration, NASA Office of Chief Technologist
- 4:00 p.m. Adjournment of FACA Session
- 4:05 p.m. Non-FACA Fact Finding Session (until approximately 5:30 p.m.)

**April 29, 2011 –**

- 8:30 a.m. Meeting Reconvenes (FACA Session)
- 8:45 a.m. Technology and Innovation in NASA Commercial and Emerging Space Initiatives  
Phil McAlister, Exploration Systems Mission Directorate  
Charles Miller, Office of Chief Technologist
- 9:45 a.m. Break
- 10:00 a.m. Ethics Briefing  
Kathleen Teale, OGC
- 10:45 a.m. Discussion and Recommendations (T&I Committee)
- 12:30 p.m. Adjournment

**NAC COMMITTEE ON TECHNOLOGY AND INNOVATION  
Membership  
April 28, 2011**

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TECHNOLOGY & INNOVATION COMMITTEE MEETING  
NASA Headquarters  
Washington, DC  
April 28-29, 2011

**MEETING ATTENDEES**

***Committee Members:***

Dyson, Esther (Chair)	EDventure Holdings
Ballhaus, William (Vice Chair)	<i>[retired]</i>
Green, Mike (Executive Secretary)	NASA Headquarters
Cassidy, John F.	<i>[retired]</i>
Eichhorst, Gordon	Aperios Partners LLP
Newman, Dava	Massachusetts Institute of Technology
Rappaport, Alain T.	<i>[consultant]</i>
Ying, Susan X.	The Boeing Company

***NASA Attendees:***

Miller, Charles	NASA Headquarters
Reuther, James	NASA Headquarters
Locky, Dan	NASA Headquarters
Joseph, Marcia	NASA Headquarters
Gazarik, Michael	NASA Headquarters
Fullerton, Richard	NASA Headquarters
Parrish, Joe	NASA Headquarters
Comstock, Doug	NASA Headquarters
Ray, Carl	NASA Headquarters
Graham, Courtney	NASA Headquarters
Dastoor, Mino	NASA Headquarters
Kubendran, Laguduva	NASA Headquarters
Falker, Jay	NASA Headquarters
Teale, Kathleen	NASA Headquarters

***Other Attendees:***

Pelluntz, Lori	SRI International
Eckert, Paul	The Boeing Company
Kubik, Chris	ATA Engineering

TECHNOLOGY & INNOVATION COMMITTEE MEETING  
NASA Headquarters  
Washington, DC  
April 28-29, 2011

**LIST OF PRESENTATION MATERIAL**

- 1) Space Technology: Investments in our Future [Green]
- 2) Innovative Partnerships Update [Comstock]
- 3) Overview of OCT Early Stage Innovation [Parrish]
- 4) Space Technology Programs: Early Stage [Ray]
- 5) NIAC is Back! NASA Innovative Advanced Concepts [Falker]
- 6) Flight Opportunities Program [Kubendran]
- 7) Knowledge Capture – Portfolio talking point [Reuther, James]